Imaging algorithms/software

- I will restrict <u>my</u> discussion to imaging with closure phases/bispectrum
  - exclude parametric imaging (modelfitting) for the time being.
- Current state of the art limited by availability of data
  - Only 2 long-baseline interferometers are currently generating closure-phase data ~ a few dozen u-v points & fewer bispectrum points.
  - Other example is Keck masking data with ~ 200 u-v points, 1000 bispectrum points.
    - All currently-planned arrays will sample significantly fewer data points than Keck aperture masking.
    - Keck data is typically in the high-SNR regime, expect most future science in the low-SNR regime.
- All astronomical images made to date have used radio VLBI software
  - DIFMAP, Caltech VLBI, VLBMEM

Differences between the radio and optical

- SNR regime
  - Nothing to do with photon noise but rather with isoplanatic patch, coherence time.
  - Means we are (mostly) in the low-SNR-per-<u>coherent</u>-integration, moderate-SNR-per-<u>incoherent</u>-integration regime.
  - Implies different observables (power spectrum and bispectrum)
  - Implies different noise correlations between observables.
- Calibration
  - Poor visibility calibration (?), little-understood bispectrum calibration.
- Data set structure
  - Design constraints favour few-way combiners and baseline-switching schemes.
  - Relationship between u-v coverage and bispectrum coverage is not as straightforward as in the radio.
- Implications
  - Radio algorithms/software not well adapted to optical.
  - Observing strategy not well understood.

Things to do

- Write imaging software dedicated to the optical regime
  - Done?(!)
- Test it on simulated datasets
  - Requires agreement on "typical" source structure, science requirements, calibration regime.
  - Common imaging test datasets? Imaging "bake-off"?
- Understand observing strategy
  - What u-v and what bispectral coverage? When to use bispectrum amplitudes?
- Understand image limitations
  - What image artefacts are characteristic of given observing strategies?
  - Do they lead to science limitations?
- Test it on real data
  - Not much of it around